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13. ABSTRACT (Maximum 200 words)

We obtain a striking new phenomenon that a perturbation of such a wave produces another wave with same given end states without other time-asymptoti state. This is markedly distinct from the vicous shock waves in gas flow. The author subsequently studied the overcompressive shocks in a MHD and elasticity model. Such a wave is called intermediate shock wave, whose admissibility has been controversial since the 1950's. One of the main research interests of the author in recent years has been the qualitative understanding of vicous conservation laws such as the compressible Navier-Stokes equations. Usual approach uses typical parabolic techniques such as spectral and energy methods, or maximum principle. These methods are of limited effectiveness because they fail to detect the hyperbolic mature of underlying inviscid models. A new approach is introduced to incorporate the nonlinear coupling of waves pertaining to different characteristic families, such as nonlinear acoustic wave and entropy waves in gas flow.

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FINAL REPORT FOR AFOSR-89-0203

During the duration of my AFOSR grant, 1989-91, the author was a faculty at the Courant Institute, New York University. The grant allows the author to organize a shock wave seminar. The weekly seminar was well-attended by the faculty, graduate students and visiting scholars. The author continued the research on shock waves. With Zhouping Xin, a junior faculty at NYU, we study the nonlinear stability of viscous overcompressive shock waves:

(i) **Stability of viscous shock waves associated with a non-stability hyperbolic conservation laws**, Comm. Pure Appl. Math. (Accepted).

In it we obtain a striking new phenomenon that a perturbation of such a wave produces another wave with same given end states without other time-asymptotic state. This is markedly distinct from the viscous shock waves in gas flow. The author subsequently studied the overcompressive shocks in a MHD and elasticity model. Such a wave is called intermediate shock wave, whose admissibility has been controversial since the 1950's. In the following paper it is shown that such a wave is stable as in (i) but not uniformly with respect to the strength of dissipations.

(ii) **On the viscosity criterion for hyperbolic conservation laws**, Proceeding of SIAM workshop on Viscous Profiles, M.Shearer. ed.(to appear).

This shows that intermediate shock waves in MHD is physical provided that they are subject to perturbation small compared to the strength of dissipation. In particular, these waves are not admissible for the inviscid MHD model.

One of the main research interests of the author is recent years has been the qualitative understanding of viscous conservation laws such as the compressible Navier-Stokes equations. Usual approach uses typical parabolic techniques such as spectral and energy methods, or maximum principle. These methods are of limited effectiveness because they fail to detect the hyperbolic mature of underlying inviscid models. In the following paper a new approach is introduced to incorporate the nonlinear coupling of waves pertaining to different characteristic families, such as nonlinear acoustic wave and entropy waves in gas flows.

(iii) **Interaction of nonlinear hyperbolic waves**, Nonlinear Analysis, Proceeding, 1989 Conference, Academia Sinica, R.O.C., World Sci., pp. 171-183.

During the period of the author's tenure at NYU, two students were supported by the Grant. Each of the two Ph.D. students had already written up a paper. Each is writing a second paper. Tong Li works on combustions. The following paper obtains the first analytical result on the qualitative behavior of Majda's model:

(iv) **On the Riemann problem for a combustion model.**

In it she shows that the important Riemann problem has a global solution which tends to the well-known ZND detonation wave.

Yanni Zeng works on viscoelasticity with fading memory. Earlier basic works of Dafermos, Mohel, Hrusa, Renardy, etc. establishes the time-asymptotic stability of constant states and also the local well-posedness of the model. Yanni shows that the model is time-asymptotically equivalent to the visco-elasticity of rate type, which in terms is equivalent to Burgers equation. Thus in the following paper she not only obtains the time asymptotic behavior of the solutions but also relates it to a well-known basic nonlinear equation:

(v) **Convergence to diffusion waves of solutions to nonlinear visco-elastic model with fading memory.**

Tai-Ping Liu